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NOTES ON THE LIFE-HISTORIES OF SOME NOTODONTIDÆ.

BY A. S. PACKARD.

PART II.

Nadata gibbosa *Abbot and Smith.*

The eggs were received from Mr. H. Meeske, and hatched June 12. They were laid on the oak, and the larvæ were raised on the leaves of that tree. Compare also the description of the five stages by Miss Soule in *Psyche*, Vol. VI, p. 197.

Egg.—Described by Miss Soule (*Psyche* vi. 197). I still need specimens for examination under high powers of the microscope.

Larva, stage I.—Length 2.5 mm. The head is large, full and rounded, pale green, with a yellowish tinge like the body, only clearer, more amber-like; it is wider than the body, which is pale yellowish green. The body is smooth, without distinct piliferous tubercles, though there are scattered long, fine glandular hairs, which are ochreous-brown in color, arising from microscopic tubercles. These hairs under a $\frac{1}{2}$ inch objective at first appear to be simple tapering hairs, but after close observation are seen to be clear and slightly flattened and bifid at the tip. The body tapers regularly from the prothoracic segment to the end.

Stage II. (End of stage?)—Length 12 mm. June 20. The head is rounded, smooth, as wide as the body where it is thickest; yellowish green. The body is cylindrical, tapering decidedly toward the end; the segments are distinctly wrinkled above. The body is pale green, with two broad diffuse yellowish longitudinal bands, one on each side from the prothoracic segment to the end of the body. The hairs are minute, and, with the tubercles they arise from, not easily seen.

Stage III.—Length 13 mm. June 23. Of the same shape as before. The head is still much wider than the body; it is a little deeper green, but the color of the body differs from that of the previous stage in being whitish glaucous-green, since the body is covered with a soft whitish exudation or bloom, so as to obscure the lateral faint stripe.

Stage IV.—Length 18 mm. June 29. The head is very large, wider than the body and pea-green in color, while the body is more whitish, covered with a white bloom. The lateral pale, straw-yellow line is not very distinct. There is a faint, very narrow, vas-

cular median dorsal-line over the dorsal-vessel. The skin is wrinkled above, and flecked above and on the sides with white. *The suranal plate is well rounded and edged with straw-yellow.* The prothoracic segment is much wider than those behind, and the body tapers rapidly towards the end. The spiracles are ringed with light sienna-brown, rendering them rather conspicuous. The thoracic and abdominal legs are pale green.

Stage V.—Not described, but closely resembles the full-fed larva.

For a description and figure of the full-fed larva see Lintner, Ent. Contr., III, p. 150, and our Forest Insects, p. 154, Pl. XI, fig. 6, after Lintner; also Miss Soule (l. c.).

Summary.—1. The freshly hatched larva is in shape like the adult, only the head is larger in proportion, and the body is provided with bulbous glandular hairs. There are no lines nor white dots.

2. The two subdorsal yellowish longitudinal stripes probably appear at the end of the 2d stage.

3. In stage III. the whitish bloom appears.

4. In stage IV. the suranal plate is edged with yellow.

This is, next to *Gluphisia*, the simplest, least specialized Notodontian larva; more so than that of *Lophodonta*. The body is without tubercles or humps; the piliferous warts are minute and the simplest markings are colorational, *i.e.*, two yellowish subdorsal bands, with no spots. In the Notodontians the subdorsal lines are the first to appear, before the lateral ones. This is probably as near the primitive ancestor of the Notodontians as any known genus, unless *Gluphisia* be excepted; the larva of *Lophodonta* is nearly if not quite as simple in shape and ornamentation as that of *Nadata*.

Lophodonta angulosa *Abbot and Smith.*

A detailed description was published in Forest Insects, p. 154, comparisons being made with the larva of *Nadata gibbosa*; but in the following description some features are noted which do not appear in the published description.

It occurred at Brunswick, Me., September 8, on the oak, and at Providence, R. I., in September and early in October.

Full-fed Larva.—Length 40 mm. Resembling in its simple, smooth body, without tubercles or humps, the larva of *Nadata gibbosa*, but the head is smaller, and it has no such suranal plate, while the body is smooth not granulated. The head is nearly as

wide as the prothoracic segment, but not as wide as the body; it is full and rounded, though a little flattened above; it is deep pea-green, but concolorous with the body; on the vertex are four short, faint whitish lines (sometimes wanting), the inner two parallel, the outer somewhat diverging; each side of the clypeus is lined with whitish; on the side of the head is a pink line edged above with white and extending to the base of the antennæ. The mandibles are green at base with an orange-red line along the upper edge, the tips being black. There is a short, black line above at the base of the antennæ.

The body is noctuiform, tapering towards the anal legs, which are short and small, no larger than the other abdominal legs. The suranal plate is small, rounded at the end, not large and conspicuous as in *Nadata gibbosa*. The segments are not convex, but the sutures are distinct. A double median, whitish, somewhat broken line, sometimes faint, the two lines converging and forming a single one in the middle of the suranal plate, and slightly tinged with pink. A distinct lateral pink line begins on the side of the head and extends to the end of the body along the edge of the suranal plate; the line is somewhat finely bordered with brown, and is edged below with white. In one specimen along the sides of the body are two broken yellowish-white lines, the lower of the two more broken and yellowish than the upper one, and represented by two spots on each segment; it lies midway between the upper and the pink and yellow spiracular line.

The whole body is pea-green, or sometimes suffused with a roseate or pinkish tint; it is slightly darker below than along the back. The thoracic legs are greenish-amber, spotted externally with black. The abdominal legs are green like the body.

In some examples the lateral reddish spiracular line is not so distinct, while the white lower edge is nearly obsolete.

***Datana integerrima* G. & R.**

This and the following descriptions of *Datana* larvæ, are rather more detailed than those given by other entomologists and refer to some features which have been overlooked.

The larva was received from Mr. James Angus, August 25. Feeds on butternut, walnut and hickory.

Larva, stage IV.—(Supplementing that of my paper in the Proceedings of the Boston Society of Natural History, Vol. xxiv. pp. 518 & 519).

Length 15 mm. Head shining black, as wide as the body.

The body of the usual cylindrical shape, rather slender, dark pitchy reddish brown all over. Prothoracic shield transversely oblong, not so square at the corners as in *D. perspicua*. There are four dull whitish rather obscure lines on each side, which are of nearly the same width and of exactly the same color; they are somewhat irregular on the edges, being somewhat broken and of the same distance apart. The lowest or infraspiracular line is a little wider and more distinct than the others and extends along the lateral ridge. The body beneath is of the same color as above. The suranal plate is black, rounded; the anal legs are black at the tips. The middle abdominal legs are stained black above the plantæ, and the thoracic legs are black. The hairs are long and white; those on 1st thoracic segment, and 8th and 9th abdominal longer than those elsewhere; those on the prothoracic segment stand up and curl over the head, and two or three of them are as long as the three thoracic segments put together. The spiracles are black.

***Datana contracta* Walker.**

The larvæ were sent me by Mr. James Angus, and were received Sept. 1. It feeds on the walnut and will eat the ash or rose.

Full-grown larva.—Length, 30 mm. Head large, as broad as the body, entirely black; including the mouth-parts. 1st thoracic segment with a distinct gamboge-colored transversely oblong plate, with three indistinct blackish clouds on it. The body is jet-black, with four continuous whitish-yellow very distinct stripes on each side, and a fifth broken one between the bases of the legs, both thoracic and abdominal. The three upper stripes are equidistant, the upper or subdorsal one being slightly wider than the others. The 4th stripe is on the lateral ridge and is broader than the others and wavy. The width of the dorsal black stripe is like that of *D. perspicua*. There is a median ventral whitish yellow stripe which ends before reaching the anal legs. The thoracic legs are black, but gamboge-yellow at the enlarged fleshy base. The middle abdominal legs are gamboge-yellow, each with a large external black patch above the planta. The two subdorsal whitish yellow lines end before reaching the suranal plate, leaving a black space; the plate is also black, and the anal legs are wholly black above and beneath and on the sides. The head and body are clothed with long white hairs, much longer and thicker than in *D. perspicua*, and longer than the body is thick.

Datana perspicua G. & R.

The specimens described below were received Aug. 23, from Mr. James Angus, and so named by him.

Larva, stage III or IV?—Length, 17 mm. The head is black, not quite so wide as the body. A shining black chitinous transversely oblong prothoracic shield. The body is moderately hairy, the hairs reddish; it is deep straw or lemon-yellow, with eleven pitchy reddish lines: the median dorsal line is much broader than any of the others and broader than the spiracular line; of the two subdorsal lines, the upper is a little wider than the lower; the lowest or infrspiracular line is interrupted by the sutures; the two ventral lines of the same reddish color pass along at and including the base of the thoracic and abdominal legs. The suranal plate is small shining black. The anal legs are conical, black, except the reddish planta which is distinctly reversible, being seen at times to be retracted, though armed with hooks. The two paranal plates are dark at the end; the end of the body is constantly upheld. The thoracic subdominal legs are black.

Immediately after moulting one can see the fluids of the body under the neck; the head is cherry red, while the suranal plate, anal and other abdominal, and also the thoracic legs are pale carneous.

Stage V?—Length at first, 20 mm, becoming the next day 23–25 mm. Body as before, but the stripes are blackish red, there being no other change of importance. The suranal plate is a little larger than before.

Last stage.—Length, 40 mm. Head large, black, as wide as the body.. Prothoracic shield dark reddish black.

The stripes are of the same relative width as in stage III, but have lost their red color, and are brown black, while the yellow of the body has a greenish tinge. There is no red at all on the prothoracic segment or on the legs or on any part of the body. The suranal plate is large and black, the black median dorsal line wider on the segment in front. *The hairs are now whitish and thicker than* in the previous stages.

Note.—When irritated it discharges a drop of green fluid, its partly digested food.

I notice that the hairs on the thoracic segments have at times an individual motion, and are jerked one way and another, as also the warts which give rise to them!

One pupated Sept. 20, and another a little later.

Datana ministra Drury.

It occurred at Providence, R. I., on the birch, Sept. 10–12. Figured in Forest Insects, Pl. IV, figs. 1, 2.

Stage next to last.—Length, 26 mm. Head black, as wide as the body. 1st thoracic segment black. The body is *yellow*, not greenish-yellow, as in the adult, and the stripes are *reddish-brown*, the color of brown roofing slate. Just before molting the 1st thoracic segment becomes gamboge-yellow on the plate, and straw-yellow around the edges. A broad dorsal reddish brown line fully twice as wide as the others. There are four lateral stripes all of the same width, the yellow spaces between them only a little more than one-half as wide as the brown bands; the 3d brown band includes the black spiracles. Thoracic feet black; suranal plate and anal legs black; middle abdominal legs dark, four of the legs pale livid reddish; plantæ pale. The hairs are minute, short, not apparent without a lens.

The head and thoracic segments often held bent over backwards, so that the thoracic feet stick up, while the tail is so bent up as to nearly meet the head.

Last stage.—Length, 30 mm. Head black. Body with *white, conspicuous hairs*, many of them one-third longer than the body is thick. The body is now *distinctly greenish-yellow*, and the prothoracic plate gamboge-yellow. The stripes are *black*, not reddish dark brown, as before. The 3d or spiracular band is *a little wider than before*, and continued on to the prothoracic segment, under the gamboge-yellow plate. Base of the legs and space around and between them *honey-yellow*, not dull reddish-yellow, as in the previous stage. Middle abdominal legs reddish-yellow, with a large black chitinous plate above the planta.

Datana angusii G. & R.

The specimens here described were received under the above name from Mr. James Angus, Sept. 4. I failed to note their length, but they were nearly if not quite full-grown.

Head black, including the mouth parts. The prothoracic shield is distinct, transversely oblong, black. Body black, with four narrow pale whitish-yellow stripes on each side. The two dorsal stripes are wide apart, leaving a broad dorsal median black stripe; the space between the 1st and 2d line is a little wider than between the 2d and 3d; the 4th line is slightly wider than the others, scalloped, and interrupted by the sutures between the segments. Beneath the lateral ridge along the base of the legs is

an irregular livid purplish stripe beginning on the 3d thoracic segment. *There are no hairs along the back and those along the side are unusually short and are pale grayish in color.* The body beneath is black, with a median livid pinkish line along the abdominal segments, widening between the abdominal legs, and ending on the 7th segment, the end of the body, including the anal legs, being black.

Notodonta stragula Grote.

This larva occurred on the aspen at Brunswick, Me., August 14. In the stage before that described and figured in my report; it feeds on the edge of the leaf.

Stage III?—Length 12 mm. Head large and broad, wider than the body, and flattened in front, narrowing towards the vertex, where it is slightly bilobed, and bearing a broad, straight, dark amber-brown band on each side, edged with pale whitish on the outside. The body is a rich purplish, becoming darker below and on the under side, *with no reddish tints such as occur in the next stage.* The nutant projection on the 2d abdominal segment is large and well developed and inclined backward, *while the 2d one is very small, much smaller than in the next stage,* being about one-third as large as the one in front. The dorsal hump on the 8th abdominal segment is conical, with a broad median lilac amber-brown band passing back on to the suranal plate, and forwards over the projection in front to the head. The sides of the humps are stained whitish and ochreous, with two short, wavy stains in front, one set on each side of the body. The thoracic legs are dark; the abdominal legs paler and nearly concolorous with the peculiar, velvety purple of the body, and somewhat darker. The piliferous warts are small, but pale and distinct. On the side of the prothoracic segment above the legs is a short, narrow, horizontal pale-yellow line.

For a description of the fully grown larva, see Proc. Bost. Soc. Nat. Hist., Vol. xxiv, p. 524, and for a description and figure of stage IV. see my report on Forest Insects, p. 563, Pl. v, fig. 1.

Pheosia rimosa Packard.

Mr. Dyar has described (Psyche, Vol. vi, p. 196) at length all the stages (five) of this species (*P. dimidiata* H.S.) from California, where it feeds on poplar and willow.

The eggs and freshly hatched young were observed on the under side of the leaves of the aspen, the 26th of July and 1st of

August. The female lays usually three eggs near together on a leaf. The larva does not appear to eat them up, as the eggs are found throughout the month, with simply the hole gnawed by the larva in making its exit. The young larva is solitary, and eats a patch on the under side of the leaf. The larva in the second and later stages were unusually frequent in Maine in 1890.

Egg.—Diameter 1.3 mm. Low hemispherical, about one-half as high as broad. Under a Tolles triplet the micropyle in the centre is distinctly seen, and the snow-white shell is distinctly though very finely pitted or granulated. Under a half-inch objective the markings are seen to be very peculiar, the surface not being divided into polygonal areas, but studded with microscopic beads, which form near the micropyle at the apex radiating series, and lower down lines of beads more or less parallel with the equatorial diameter. From 3 to 7 eggs are laid on a single leaf. Probably the moth flies from one plant to another, laying a few eggs at a time.

Freshly hatched larva, stage I.—Described a few hours after hatching, before they began to feed. Length 3.5—4 mm. The head is rather large, shining black, smooth, and considerably wider than the body; not spherical in shape, but somewhat flattened and sub-cordate or bilobed, as the occiput is deeply indented. A large broad, but antero-posteriorly rather short black, mostly smooth prothoracic plate, with slight roughnesses near the front edge where the hairs take their origin; the hinder edge slightly indented on the median line. On each side of the plate is a lateral black piliferous wart. The 2d and 3d thoracic segments each with a pair of conspicuous, oval, black, flattened, piliferous warts, and two small, round ones on each side, the lower one being about one-half as large as the upper. Abdominal segments 1—6 each with four dorsal, piliferous, flattened black warts, the hinder ones a little farther apart than the anterior ones, but yet close to the latter. On segment 7 the four corresponding warts are arranged in a regular trapezoid, the two anterior ones being much nearer together than the two hinder ones. On the 8th segment is a single central dorsal black, oval, moderately prominent wart, which is twice as large as the largest on the 9th segment; it is transverse, bearing a bristle at each end, thus having plainly originated from what was once two separate warts. The latter segment bears 4 black warts, arranged in a regular trapezoid. The 9th and 10th segments are held up when the larva walks. The anal legs are black and a little smaller and shorter than the middle abdominal legs. The

black suranal plate is sub-triangular, being obtusely pointed in front; the surface is rough, bearing a rough, low tubercle in front on which are minute piliferous warts. The body is somewhat flattened, being broader than high, and of a peculiar, pale glaucous- or sea-green, the skin being polished like porcelain.

The hairs under a $\frac{1}{2}$ inch objective are seen to be slightly bulbous at the tip, and therefore glandular, but under a lower power appear to taper like ordinary setæ. In stage II. the hairs are also slightly bulbous, and clear at the tip.

At the end of stage I.—Length, 5–6 mm. The body is much longer than before, so that the tubercles are farther apart, and now the 8th segment has the dorsal wart surrounded by an amber-yellow spot rendering it more conspicuous, and also the lateral concolorous line has appeared; the same tint occurs on the base of the abdominal legs.

(Specimens described in part from life, Aug. 2). Length at the end of the stage, just before exuviation, 6 mm. The head is moderately large, in the single larva observed not so wide as the body, as it was about to moult, the prothoracic segment being greatly swollen. (In alcoholic specimens, the head and black piliferous tubercles of the larva in the next stage can be seen through!) The head is now black and slightly bilobed, and 1.5 mm. wide.

The prothoracic plate is rather broad, but quite short antero-posteriorly, with four piliferous warts on the front, and four on the hinder edge. The piliferous warts on the succeeding segments are large, distinct, black, and bear but a single hair. The tubercles on the 2d and 3d thoracic warts are arranged in a straight transverse row; the two dorsal ones are slightly larger than those on the 3d thoracic segment. On the abdominal segments the four dorsal tubercles are all the same size and arranged in a trapezoid, which becomes longer going backward to segment 7. On the 8th segment there is a *double large black tubercle* bearing two bristles, the tubercle is several times larger than any of the others, and is evidently the result of the coalescence of the homologues of the two dorsal warts occurring on the segments in front. The 9th segment with the four dorsal tubercles arranged in a square, with the lateral ones farther up on the back than the homologous ones in front, and in a sub-dorsal position. The suranal plate is black-brown, nearly three-fourths as long as broad, bearing six marginal and two dorsal median hairs. The thoracic

legs are black ; the abdominal legs pale, with an external dark chitinous plate above the planta.

The general color of the body is glaucous-green, being of the same hue as the color of the under side of the aspen leaf on which it feeds. There is a brown dorsal spot on the 8th abdominal segment, on which the tubercle rests, while along the sides low down, at the base of the abdominal legs, and in corresponding places where the legs are wanting is a row of irregular reddish spots. The skin under a $\frac{1}{2}$ inch objective is seen to be studded with fine, dark, short, conical setæ or granulations which are largest and thickest on the sides of and at the base of the middle abdominal legs. The hairs over the body are glandular, slightly bulbous, and about half as long as the body is thick.

The two tenant hairs on the thoracic feet are knife-shaped, somewhat as in *Ichthyura inclusa*. The plantae of the abdominal legs have a much larger number of crochets than usual in larvae of stage I, as there are 26 of them, forming a nearly complete but broken circle, and the crochets themselves are rather short and blunt.

Stage II.—Length, 8 mm. Moulded Aug. 3. The Pheosia characters are now declared, owing to the transformation of the dorsal tubercle on the 8th abdominal segment into a fleshy cone or low horn ! The larva feeds on the edge of the hole which it eats out of the leaf, and at first sight may be mistaken for a saw-fly larva, owing to the dark reddish brown spots and band on the sides which resemble abdominal legs, and assimilate it in appearance to the edge of the hole, which turns dark after it has been eaten out by the caterpillar.

The prothoracic shield has now disappeared. The head slightly narrows above and is slightly bilobed, smooth and shining, a little wider than the body, which narrows a little towards the end ; it is dark chesnut-brown on the sides, pale chesnut in front. The body is pale green above, still of the same hue as the under side of the leaf. The under side is peculiar in the thoracic and short, thick abdominal legs being dark livid brown ; with a large chesnut-brown patch on the base of each, and on the 1st and 2d abdominal segments is a dark brown blotch where the base of the legs would be if they were present ; farther along in the space between the 4th pair of legs and the anal legs is an irregular dark brown broad line extending along the side of the body to the sides of the anal legs. The latter are used in creeping, but but are about half as large as the middle ones.

The hump on the 8th abdominal segment is now *well developed, high, conical, and fleshy, slightly inclined backward*, dark at tip, and still bearing two bristles, though the dark chitinous spine is obsolete; the horn-like tubercle is half as high as the segment is thick. The body behind the "caudal horn" narrows rather rapidly to the end of the suranal plate, which is larger than before, but pale and of the same color as the body.

The anal legs are used, but are about half as large as the middle ones and with much fewer crochets, which are very numerous in the middle legs, *forming a nearly complete circle*. The piliferous warts in general are now very much smaller and paler than in stage I, being *green like the body*, and scarcely visible under a strong lens. The hairs are sparse, only one arising from a wart, and they are short and fine.

In this stage the sub-prothoracic eversible gland was observed in an alcoholic specimen. It forms a large transverse sack, (bleached white by the alcohol, and contrasting with the red skin of the side of the segment. It sends off two lateral siphon-like long and slender finger-shaped diverging tubes, out of which the spray is probably forced. Their ends do not reach to the sides and are not visible from them, but the gland is much as that of *Cerura* as figured by Poulton. (Trans. Ent. Soc. London, 1887, Pl. X, fig. 7).

Stage III.—Aug. 6. Length 11 mm. The head is now pale amber, but still dusky on the vertex, and it is also still wider than the body. On each side of the body is a faint whitish sub-dorsal line. The "caudal horn" is dark brown, now nearly as long as the 8th segment is thick vertically. The horn is slightly retractile in this stage, and the base is movable, being capable of withdrawal and extension and is distinctly nutant, the apex sometimes hanging over backwards. The sides of the body along the base of both the thoracic and abdominal legs are now dark reddish chocolate brown, being of the same color as the horn.

The lateral yellow line is well marked. The body beneath is pale green. The spiracles form a dark dot surrounded by pale greenish.

Stage IV.—Length 20 mm. Aug. 25. The body is now thicker than before. The head is distinctly bilobed, rounded, narrowing a little towards the vertex. The caudal horn is now larger, higher and more acute than in the preceeding stage; it is freely elevated or allowed to fall over backwards, is soft and flexible, but very slightly retractile, and bears a few scattered

fine bristles. It has a blackish shade extending up from a point above the last spiracle to the apex, which is dark. The body is chocolate colored; the head redder, finely mottled with paler reddish. The suranal plate is well rounded behind, the surface roughened, with no piliferous warts, and this and the anal legs are more reddish than the body, being of a reddish pink hue. The spiracles are much larger than in stage III, and are blackish, surrounded by a broad, pale, flesh-colored ring. The middle abdominal legs have a shining chitinous black patch above the planta, there being no such patch on the anal legs. The thoracic legs are dark, pitchy amber.

For the last stage see my description in Proc. Boston Soc. Nat. Hist., Vol. xxiv, p. 523.

Recapitulation :—1. The median dorsal tubercle or incipient "horn" on the 8th abdominal segment is in stage I plainly seen to be double, the result of the coalescence and specialization of what were originally two dorsal warts. In stage II, this tubercle becomes a well developed, high, conical, fleshy horn.

2. The prothoracic plate of stage I disappears in stage II.

3. Appearance in stage II of the dark reddish brown spots and band on the sides of the body.

4. Appearance in stage III of traces of a whitish subdorsal line, while the lateral yellow line is well marked.

***Edemasia concinna* Abbot and Smith.**

The later stages of this caterpillar, beginning with the second, are described by me in the Proceedings of the Boston Society of Natural History, Vol. xxiv, 531. I found the eggs with the larvæ just hatching on the leaves of the willow at Brunswick, Maine, June 24. The eggs were in this case somewhat scattered, and few in number, and the larvæ did not feed gregariously. The larvæ continue to hatch till the early part of August in Maine, as Aug. 14, I found the larvæ in stage II, and also fully grown on the aspen.

Egg.—Diameter about 1 mm. Low hemispherical, the height being about half the diameter. The shell is thin, smooth, and under a triplet not seen to be pitted, but under a half-inch objective the surface is seen to be divided into regular, moderately large polygonal areas, with slightly raised but distinct edges.

Freshly hatched larva.—Length, 3 mm. Head large, globular, smooth and unarmed, a third wider than the body, deep dark, honey-yellow. The body is greenish-yellow above, cherry-reddish on the sides; the prothoracic dorsal tubercles are larger and

higher than those on the 2d and 3d thoracic segments, and connected by a chitinous band, becoming more distinct in stages II and III. The 1st and 8th abdominal segments are reddish, including the pair of dorsal tubercles which are of the same size. The end of the body is held up, much as in the fully grown larva, and I mistook it for a *Schizura* larva, until after it had molted, as the tubercles are conical in this stage as in freshly hatched *Schizura*.* In some individuals the greenish dorsal tubercles are dark at the tip. The glandular hairs are bulbous at the tips, and a few at each end are nearly one-half as long as the body.

Three days after, June 27, they became 5 mm. in length, the head now small and the larvæ were preparing to molt; and July 29-30, three cast their skins.

Stage II.—Length, 4-5 mm. at first. Now the body is like dark opaque varnish in hue. The head is dark reddish varnish or pitchy in hue, and decidedly narrows above, bearing two blunt knobs on the vertex; it is now wider than the body. The prothoracic shield is larger than before. The sides of the 2d and 3d thoracic segments are yellowish with reddish lines, and on the sides of the 7th abdominal segment is a pair of lobed bright straw-yellow spots converging behind, and lower down are three yellow tubercles tipped with brown. There is a similar single yellow tubercle on each side of the 9th segment. The prothoracic dorsal tubercles are somewhat smaller than those on the 1st abdominal segment, and the 8th pair are also a little smaller, but all the other dorsal tubercles are still large and conspicuous.

***Schizura ipomeæ* Doubleday.**

The following description of two larvæ found at Brunswick, Maine, on the red maple, Aug. 14, describes the peculiar mimicing coloration better than those hitherto published.

Full-grown larva.—Length, 28-30 mm. Wonderfully mimics a dull blood-red portion of a leaf which had been cut partly off and become somewhat twisted, so that the larva itself would easily be mistaken for such a part of a prominent terminal leaf. The deception was perfect, as I did not myself at first see it when within ten inches of my eyes, and on holding it before the eyes of an observing boy of thirteen he could not at first distinguish it as a caterpillar. The same leaf had blotches of dull red, and the flesh-red abdominal feet of the caterpillar clasped the concolorous red leaf-stalk. One larva was much deeper blood-red in color than the other, the latter having a more faded tint.

* *Cedemasia* is probably only a section of the Genus *Schizura*.

The head is high and narrow, not so wide as the body, but wider than the 1st thoracic segment; it is pale livid purplish, darker down the front, with two parallel black-brown lines on each side, bordered with paler, and enclosing a clear pale purplish band. The clypeus, labrum, antennæ and region near the eyes are pale. A minute piliferous wart on each side of the vertex. The 1st thoracic segment is mottled with reddish, and pale flesh on the sides. A dorsal broad band, divided in the middle by a pale yellow line becomes one-half as wide behind on the 2d thoracic segment, and passes back to the horn on the 1st abdominal segment; the rest of the 2d and 3d thoracic segments are pea-green, a little paler than the upper side, and darker than the under side of a red-maple leaf, but on the whole very closely assimilated in tint to the color of the leaf.

The abdominal segments are in general faded, dull blood-red, due to fine, dark, flesh-red lines and mottlings on a pale carneous ground. On the first abdominal segment is a high nutant fleshy, soft dorsal tubercle which is inclined a little backward, but on being touched bends over downward near the back; the basal half is mottled and lined like the sides of the segment from which it rises, but above becomes bright, clear, blood-red, the end being deeply forked, each fork bearing a long black bristle. A median black line passes along the tubercle, becoming forked in front and behind at the base. Two large, high twin soft tubercles on the 5th segment are not quite so large as the two similar ones on the 8th segment, but are situated on a much larger hump; they are of the same blood-red hue as those on the 1st segment. The small dorsal tubercles on the 2d and 3d abdominal segments are minute and yellow; those on the 4th are partly blood-red. The anal legs are long and slender. On the back of the abdominal segments 1—4 is a porcelain white band, bordered with faint yellow, and divided by the sutures; the portion on the 1st segment behind the tubercle is triangular, that on the 4th round; they each contain three deep pink lines more or less broken and irregular. The v-shaped mark consists of a white oval (acute in front) spot on the 6th segment, and the two arms of the v are formed by two converging oval spots, with a yellowish white spot between the forks. The thoracic legs are pale flesh; the middle abdominal legs of the color of the leaf-stalk, while the anal legs are paler. Beneath, the body is green on the three thoracic segments, this color being continued back as a narrow band to the 1st pair of abdominal legs; otherwise much as on the sides of the body.

Schizura leptinoides Grote.

The eggs were laid by a species of *Schizura* and sent by Miss Emily L. Morton, who is quite sure that it was *Schizura leptinoides*. They were laid June 3, at New Windsor, N. Y., they hatched June 12, all the others being out of the shell by noon of the next day. I did not carry it beyond the first stage, but have little doubt but that Miss Morton's identification of the moth was correct.

Egg.—Transverse diameter 1 mm. of the same size and shape as those of *S. ipomeæ*. Hemispherical, moderately high, and under a high Tolles lens seen to be very finely pitted; under a $\frac{1}{2}$ inch objective of Tolles the surface is seen to be divided into 5 and 6-sided areas, with a distinct raised edge; the surface smooth and more often without the bead, so common in eggs of *S. ipomeæ*.

Towards and at the micropylar region the cells become longer, minuter and more crowded, and in this respect the egg seems to differ from those of *S. ipomeæ*, in which the areas are more or less obsolete in the micropylar region.

Freshly hatched larva.—Length, 3 mm. The head is very large, nearly twice as wide as the body; deep honey yellow.

Prothoracic segment of the same tint as the head, but green behind. The rest of the body is pale yellowish green, with rather large honey-yellow warts. The 1st and 8th abdominal segments are deep cherry-red, while the sides of the 2d to 7th segments above the legs are the same color. On the 1st and 8th segments is a pair of dorsal cherry-red tubercles, those on the 1st somewhat larger than those on the 8th segment; those on segments 2 to 7 are small, of nearly uniform size, and concolorous with the greenish yellow segments. The end of the body, including the anal legs and the 9th and 10th segments, is upheld as usual in the genus. The thoracic and first four pairs of abdominal legs are dark. The anal legs smaller than those in front and are pale, being of the same color as the end of the body. The glandular hairs are distinctly seen to be bulbous at the tip, and long and unequal in length; the two longest ones, *i. e.* those on the prothoracic segment being about three times as long as the body is thick.

Compared with the larva of *S. ipomeæ* of the same stage, the two dorsal warts on the prothoracic segment appear to be a little smaller. The glandular hairs seen under a $\frac{1}{2}$ inch objective, are of the same length, and general shape as in *S. ipomeæ*, but do not appear to be quite so bulbous.

Within the egg the larva lies with the front of the head next

the top of the dome, so that the jaws are opposite the upper side, hence when it eats its way out of the shell, the more or less bean-shaped opening is on one side rather high up, near the summit.

Fully-fed larva.—In Maine, at Brunswick, the caterpillar occurred fully fed on the beech and also on the hornbeam, during the first week in September.

This species is of the color of a dry, sere leaf, with no green upon the body, and is thus readily separated from *S. ipomeæ*; besides the body is thicker; it bears a striking resemblance to a part of a dead leaf, and several leaves were noticed with portions partly cut off and somewhat curled up, to which the caterpillars bore a striking resemblance, both in shape and color.

It was observed that the high dorsal tubercle on the first abdominal segment is both nutant and slightly retractile, being invaginated when irritated.

The larvæ also occurred at Providence, R. I., through September on the chestnut.

It is also figured in Ms. by Major Leconte as living in Georgia.

For descriptions of stages II and III drawn up from alcoholic specimens, see my paper in Proc. Boston Soc. Nat. Hist., Vol. xxiv, p. 539, 1890.

Length, 25–30 mm. The body is compressed as usual. The head is somewhat notched above, large and high, compressed, clay-yellow, with two broad dark bands in front, which are made up of irregular wavy dark lines and spots. The labrum is carneous. A pair of minute piliferous tubercles on the back of the 3d thoracic segment. On the 1st abdominal is a large high fleshy cylindrical nutant tubercle of the same yellowish color as the body; it nods back and forth freely as the creature walks; it bears a pair of cylindrical chitinous piliferous tubercles with bases rather wide apart, and which are reddish black at base, and pale at the tips. On the 5th abdominal segment is a large broad fleshy hump, concolorous with the body, from which arise two low conical nutant fleshy tubercles, each bearing a low chitinous piliferous tubercle. (This hump with its tubercles are not developed in *S. unicornis*). The 8th abdominal segment is provided with a prominent narrow fleshy hump bearing two small piliferous warts. The anal legs are about one-half as thick as the middle abdominal legs.

The body is uniformly the color of pale unburnt or Philadelphia brick, or of the same tint as a sere, pale brown leaf, *with no green upon it*. There is a broad dorsal dark brown stripe along

the thoracic segments, which is continued upon the base of the head, which bears a broad triangular dark spot. Behind the 1st abdominal hump is a long triangular flesh-colored dorsal band; on the 3d abdominal segment is a shorter similar patch, while a similar carneous band on the 4th segment breaks up into three diverging stripes ending at the suture. The V-shaped dorsal spot on the 6th and 7th segments is faded pink edged with clay-yellow, and dark brown. Along the abdominal segments is a narrow dark supraspiracular line. The thoracic and abdominal legs are, like the body, pale, with reddish lines.

The apparent aim or rather the result of the action of the environment has been to produce a caterpillar whose shape and color represent a sere, brown, more or less twisted portion of a serrated leaf such as that of a beech, hornbeam and similar trees.

It differs from any other species known to me in lacking any green color on the thoracic or other segments of the body.

Hyparpax aurora *Abbot and Smith.*

The young were reared from eggs kindly sent me June 26, by Miss Emily L. Morton of New Windsor, N. Y.

Larva, stage I.—Length, 2.5 mm. The head is very large and broad, about twice as wide as the rather slender body, and dull honey-yellow or chitinous in color; with a few long light hairs in front near the vertex. On the prothoracic segment are two rather large acute conical dorsal tubercles, of the same color as the head, and larger than those on the 1st or 8th abdominal segments, though all the dorsal tubercles on the body are unusually large, larger in proportion than in the 1st stage of *Schizura*; those on the 2d and 3d thoracic segments are well developed, but considerably smaller than those in front. Those on the 1st abdominal segment are situated close together, while those on the 1st thoracic segment are rather wide apart. The two on the 8th abdominal segment are not quite so large as those on the 1st abdominal segment. The glandular hairs arising from these tubercles and those on the side of the body are long, varying in length, and distinctly bulbous at the end, those on the thoracic and posterior thoracic segments being longer than those in the middle of the body, or in the allied genus *Schizura*.

The body above pale yellow, with a greenish tinge, the sides of the body being cherry-red. The 1st, 3d, and 8th abdominal segments are cherry-red all around including the tubercles, so that the body is thrice ringed with red. All the dorsal abdominal

tubercles are quite large, those on the 1st and 8th segments scarcely larger than those on the other segments. The end of the body is uplifted both when walking and at rest. All the abdominal legs are reddish, and the thoracic legs are dark.

Stage II.—Just molted, July, 1891. Evidently delayed in its growth. Length, 6 mm. Head moderately large, (now wider than the body, as the larva has not begun to feed); it narrows slightly above, and bears on the vertex *two piliferous warts which are somewhat larger than those below on the face*, of which there are five, rather large conical warts, arranged in two rows, each bearing a bulbous tipped glandular hair; the head is pale sere brown (burnt sienna), with six whitish spots arranged in two vertical rows. The clypeus and labrum are whitish. The 1st thoracic, 1st, 3d and 8th abdominal segments each bear two large high dorsal warts, which are dark at the tips; they are flanked by sub-dorsal and lateral warts which are but a little smaller; the dorsal ones in question are much larger and higher than those on the other segments, and the segments themselves are dull pale cherry red. Thoracic segments 2-3 and abdominal segments 2, 4, 7, 9 and 10, together with the tubercles, are bright yellow. The legs are all pale, though the anal ones are darker and redder. The glandular hairs are still bulbous in this stage, rather short and even; those on the 1st thoracic and 1st, 3d and 8th abdominal segments being longer than those elsewhere.

These hairs are seen under a $\frac{1}{2}$ inch objective to be unusually large, distinctly flattened at the end, which is broad and square the tips being flattened and transparent. In a few of the hairs the expanded tip appears to be ragged and broken, or toothed, and in one case deeply forked.

I have not yet seen the fully fed larva, and we need a detailed description of it, as compared with the final stage of *Schizura* and *Janassa*. A figure, by Miss Morton, of the final stage is to be found in Forest Insects Pl. III, figs. 6, 6a.

The descriptions of the following stages are drawn up from Mr. Bridgham's excellent colored figures, those of the two earlier stages having been compared with my descriptions and found to be accurate in form and color. His examples of stage I (from eggs I sent him) were drawn July 3-7, of stage II, July 12; of stage III, July 18, stage IV, July 23; stage V, and last, July 28.

Stage III.—Length, 20 mm. The head is somewhat angular, spotted with whitish *and the tubercles are larger than before*. The body has more of a lilac tint, and the tubercles which were yellow

in the previous stage are now *still deeper yellow, tinged with white rendering them more conspicuous*; a distinct lateral stigmatal line extends along 8th and 9th segments, and along the edge of the suranal plate. The end of the body is raised high up; *there is no green on the body.*

Stage IV.—Length, 25 mm. In the greater thickness, and shape of the body as well as the bright green color the larva of this stage closely resembles the caterpillar in its final stage. The head is now smoother, *the tubercles smaller*, and the dorsal tubercles on the three thoracic segments, as well as those on the 2d to 7th abdominal segments are smaller than before, *while those on the 1st and 8th abdominal segments are now larger than before, and very prominent.* The body is now of a deep delicate pea-green, with a large reddish brown triangular patch extending from the prothoracic segment next to the head, and ending at the anterior base of the tubercles on the 1st abdominal segment. Behind the said tubercles a broad reddish brown patch extends to the large tubercles on the eighth segment, the band being edged with whitish yellow; from the rear of the tubercle a similar-colored band extends to the end of the suranal plate. The under side of the body in front, and the middle abdominal legs are brownish.

Stage V.—Length, 35 mm. In shape and coloration just as in stage IV, but the head is a little darker, and *the back of the larva between the two great abdominal tubercles and also behind the last tubercles on 8th segment, is green, not reddish brown, and this area is edged with irregular reddish thread lines on a white field.* Also a lateral infrastigmatal line is present along the end of the body. In Miss Morton's figure of this larva copied in my Forest Insects (Pl. III; fig. 6, 6a.) the larva has the same style of coloration.

Heterocampa unicolor Pack.

The eggs were received from Mr. Tallant of Columbus, Ohio, Aug. 21, having been sent on the 18th, all hatching on the way.

Larva, stage I.—Freshly hatched larva. Length including the tails (stemapoda) 6–7 mm. The head is almost as wide as the body, somewhat heart-shaped, bilobed, dark chestnut, paler along the middle. The body is long and slender, especially elongated behind the 8th abdominal segment. The prothoracic segment in all the examples is full, as if it were about to molt, though it seems too soon after hatching. The prothoracic segment bears two diverging, rather thick appendages, which are cylindrical and rounded at tip; the segment at base and behind pale reddish, and cherry-red

above; the appendages are cherry-red at base, paler above, but towards the end on the distal two-thirds blackish. In front are two reddish parallel stripes. The body is pale beneath, above pale greenish yellow, the 3d and 7th abdominal segments cherry-red, including the sides, low down, of the 6th segment. From the 1st thoracic to the end of the body are three parallel lateral, linear, reddish lines, the lowermost being obsolete posteriorly. The 8th abdominal segment is convex above, but not humped. The suranal plate is small, narrow, but distinct, rough on the surface and dark, almost blackish. Behind, at the base of the tails are two piliferous warts; the tails themselves are as long as the three last segments (8-10) taken together, and are of uniform thickness, ringed with dark red, sparsely setiferous, with two or three hairs at the end; they each end in a cylindrical swollen flagellum at each end, somewhat barrel-shaped, with a deep red ring in the middle, the end being clear and transparent. All over the body the piliferous warts and hairs are minute.

It rests with the body curved around so that the head nearly touches the tails, the last three segments and tails being held up in the air, or extended and then gracefully thrown into the air.

ANOTHER LEAF-MINER OF POPULUS.

BY C. H. TYLER TOWNSEND.

In the picturesque little cañon called Cañada Alamosa, which runs several miles northwest from the town of the same name, in Sierra County, N. Mex., and opens out on the plain at Ojo, Caliente, there grows a species of cottonwood with a narrow and smaller leaf than that of *P. fremontei*. The latter is the only species found in the bottom lands of the Rio Grande in the southern part of New Mexico. This narrower leafed species is *P. angustifolia*. It also grows in the region of the Mimbres river, in Grant County, N. Mex., or a species very like it, and seems to inhabit valleys of streams in the somewhat higher region to the west of the Rio Grande valley.

Trees of this species in the Cañada Alamosa were found, June 17, 1892, to be infested with a small leaf-miner, much smaller than the leaf-miner of *P. fremontei* described from the Mesilla valley of the Rio Grande (Zoe, Vol. III, pp. 234-236, Oct. 1892), which by the way is a sawfly and not a tineid as at first suggested. The mine,